

AD-A250 623



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1. DATE

2. REPORT TYPE AND DATES COVERED

ANNUAL 1 Aug 90 TO 30 Sep 91

3. TITLE AND SUBTITLE

THE 12 UM CONTRIBUTION OF NEARBY GALAXIES TO THE
INFRARED BACKGROUND

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AFOSR-TR- 92 04 22

6. FUNDING NUMBERS

AFOSR-89-0467
61102F
2311
BS7. PERFORMING ORGANIZATION
REPORT NUMBER

8. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Dr Radoski
AFOSR/NL
Building 410
Bolling AFB DC 20332-64489. SPONSORING / MONITORING
AGENCY REPORT NUMBER

10. SUPPLEMENTARY NOTES

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ELECTE
MAY 27 1992
S A D

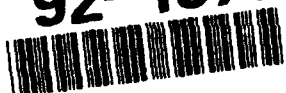
11. DISTRIBUTION / AVAILABILITY STATEMENT

12. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

The forty ultraluminous galaxies in the IRAS Bright Galaxy Sample of sources were mapped with 0.25 second resolution at 8.44 Grigahertz. Twenty five contain diffuse radio sources. These are almost certainly starburst galaxies. The IRAS flux densities for all galaxies detected in the Faint Source Survey have been obtained. The data contains a total of 1544 galaxies. The detection rate in the FSS improves substantially by a factor of three or more for the short wavelength bands at 12 and 25 microns. This sample will form the basis for studies of the far infrared properteis of optically selected galaxies.

92-13755



92 5 22 04 22

14. SUBJECT T

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION
OF REPORT

(U)

18. SECURITY CLASSIFICATION
OF THIS PAGE

(U)

19. SECURITY CLASSIFICATION
OF ABSTRACT

(U)

20. LIMITATION OF ABSTRACT

(U)

11 MAY 1992

RADOSKI/NZ

TECHNICAL REPORT ON GRANT AFOSR-89-0467

Period 01 Oct. 90 - 30 Sept. 91

Principal Investigator: Trinh X. Thuan

Graduate Students: Marc Sauvage and Richard J. Patterson

Publications (with acknowledgements to the above grant's support)

1. M. Sauvage, T. X. Thuan and L. Vigroux, "The Effects of Stellar Age and Metallicity on the Infrared Emission in the Magellanic Clouds", *Astr. Ap.*, **237**, 296-318 (1990).
2. T. X. Thuan, J. M. Alimi, J. R. Gott and S. E. Schneider, "Northern Dwarf and Low Surface Brightness Galaxies. IV. The Large-Scale Space Distribution", *Ap. J.*, **370**, 25-48 (1991).
3. J. J. Condon, Z. P. Huang, Q. F. Yin and T. X. Thuan, "Compact Starbursts in Ultraluminous Infrared Galaxies", *Ap. J.*, **378**, 65-76 (1991).
4. T. X. Thuan and M. Sauvage, "The Far-Infrared Properties of the CfA Galaxy Sample. I. The Catalog", *Astr. Ap. Suppl.*, **92**, 749 (1992).
5. T. X. Thuan and J. M. Alimi, "The Space Distribution of Dwarf and Low-Surface-Brightness Galaxies and Biased Galaxy Formation Theories", in *Physical Cosmology*, ed. A. Blanchard et al., (Editions Frontieres: Paris) (1991).

Research Highlights

1. Compact starbursts in ultraluminous infrared galaxies (publication 3, reprint enclosed)

The 40 ultraluminous [$\log(L_{\text{FIR}}/L_{\odot}) \geq 11.25$] galaxies in the IRAS Bright Galaxy Sample of sources stronger than $S = 5.24$ Jy at $60 \mu\text{m}$ were mapped with $\sim 0''.25$ resolution at 8.44 GHz. Twenty-five contain diffuse radio sources obeying the FIR-radio correlation; these are almost certainly starburst galaxies. Fourteen other galaxies have nearly blackbody FIR spectra with

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cooler temperatures $60 \text{ K} \lesssim T_c \lesssim 80 \text{ K}$ so their (unmeasured) FIR angular sizes must exceed $\theta \gtrsim 0''.25$, yet they contain compact (but usually resolved) radio sources smaller than this limit. The unique radio and FIR properties of these galaxies can be modeled by ultraluminous nuclear starbursts so dense that they are optically thick ($\tau \gtrsim 1$) to free-free absorption at $\nu \sim 1.49 \text{ GHz}$ and dust absorption at $\lambda \sim 25 \text{ } \mu\text{m}$. Only one galaxy (UGC 08058 = Mrk 231) is dominated by a variable radio source too compact ($\lesssim 1 \text{ pc}$) to be an ultraluminous starburst, it must be powered by a "monster".

2. A catalog of IRAS fluxes for galaxies in the northern sky brighter than $m_B = 14.5$ (publication 4, reprint enclosed).

We have obtained IRAS flux densities for all galaxies in the Center for Astrophysics (CfA) magnitude-limited sample ($m_B \leq 14.5$) detected in the IRAS Faint Source Survey (FSS), a total of 1544 galaxies. The FSS is an attempt to reach lower sensitivity limits than the Point Source Catalog (PSC) in the IRAS data by generalizing the coadding method to the whole sky. The detection rate in the FSS is slightly larger than in the PSC for the long wavelength 60 and 100 μm bands, but improves substantially (by a factor of ~ 3 or more) for the short wavelength 12 and 25 μm bands. 63% of all 2445 CfA galaxies were detected in at least one IRAS band in the FSS, and, compared to the PSC, we have added $\sim 50\%$ more flux densities, with the additions coming essentially all in the short wavelength range.

This optically selected sample consists of galaxies which are, on average, much less infrared-active than galaxies in infrared-selected samples. It possesses accurate and complete redshift, morphological and magnitude information, along with observations at other wavelengths, and forms the basis for studies of the far-infrared properties of optically selected galaxies in a forthcoming series of papers.